

O&M Technical Training Program Design and Analysis

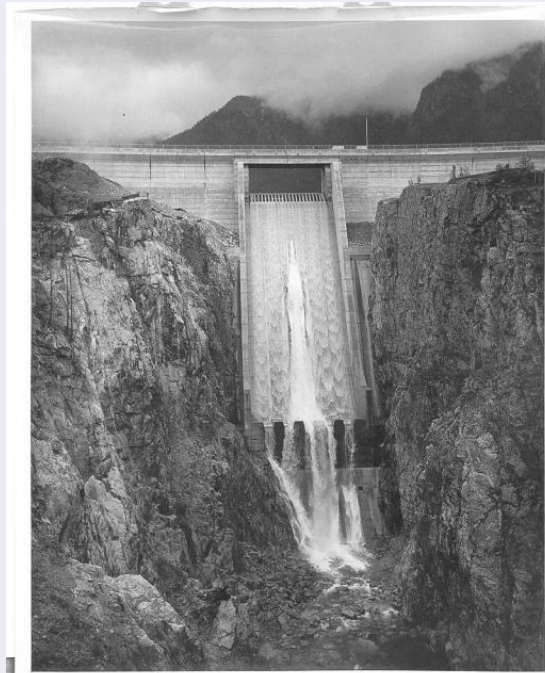


San Francisco Public Utilities Commission (SFPUC) Workforce Development Site Visit



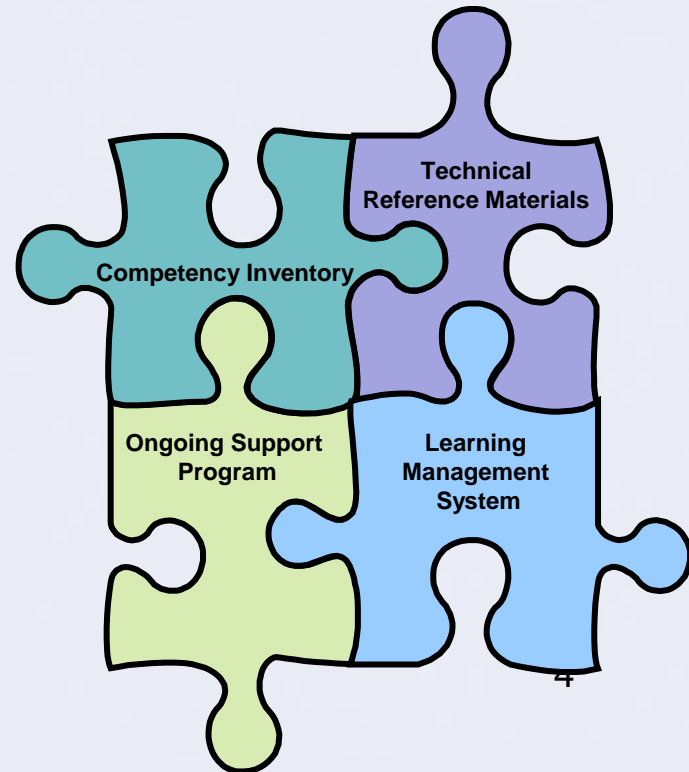
Agenda

- Training Needs Analysis
- Critical Task Analysis process and examples
- Competency Matrices process and examples
- Q & A
- Exercise

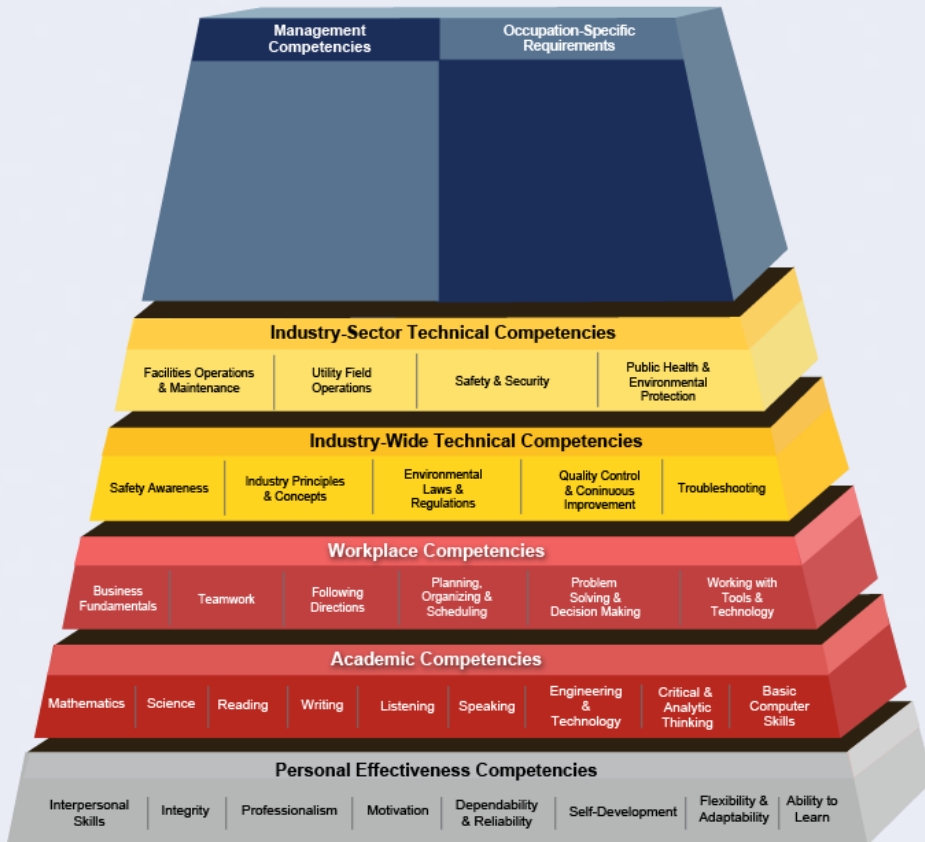


Training Needs Analysis

- Analogous to the design phase in construction
- Subject Matter Expert involvement
- Internal or consultant-led
- Deliverables
 - Task Lists
 - Competency Maps
 - Critical Task Analysis
 - Table of Contents
 - Curriculum
 - Reference Material Analysis
 - Development Plan



Competency Mapping AWWA Model



- Business and safety training already in place
- Focused on MV Specific:
 - Knowledge
 - Technical
 - Management



Competency Mapping – Process

- Generate a list of all job positions in the organization
- For each position, identify all tasks performed
- Group related tasks into roles
- Start with entry-level positions and work up to management



7. Occupational Specific Technical

Role	Task	Asst. Project Eng	Project Eng	Sr. Project Eng
System Operation	Define terms of agreement for water quality		X	
	Assist in developing OM&S manuals for select facilities		X	X
System Operation/System Control	Assist in development of procedures	X		
	Provide technical expertise (as appropriate) in review and development of procedures.	X	X	X
	Assist in development of select LKO procedures with field staff	X		
	Direct implementation of daily operating plan		X	
	Support implementation of daily operating plan	X	X	
	Direct drum gate control operation		X	X
	Participate in facility/equipment inspections.	X		
	Review approaches to water quality		X	X
Troubleshooting & Analysis	Extract and analyze data from PI and Delta V.	X		
	Identify issues and solutions.	X	X	X
	Assist with resolution of pressure/flow issues in municipalities that may be due to MV operations	X		
	Extract data from PI.		X	X
	Provide technical expertise on pressure/flow issues with municipalities			X
	Provide support for field staff as required for non-complex system failures.	X		
	Provide WT&SC expertise to assist with troubleshooting remote operation (e.g. dams, pump stations)	X	X	X
	Provide support and direction for field staff as required for non-complex system failures.			X
	Perform post-failure analysis of system.	X	X	X
	Analyze field test data.	X	X	X
	Perform post-failure analysis of water treatment facilities	X	X	X
	Collect system control and/or water treatment material and information to assist with failure analysis and resolution.	X	X	X
	Assist with response to complex failures	X		
	Collect, review, and analyze system control and/or water treatment material and information to assist with incident analysis and resolution.			X



Critical Task Analysis (CTA)

- Purpose – prioritize procedure and training material development
- Use amalgamated task list from Competency Matrices
- Evaluation team and process
- Evaluate Criticality
- Customize criteria to suit your organization
- Other information to gather



CTA - Process



CTA - Sample

Task Name	Likelihood (1-5)		Consequence (1-5)				Criticality
	Task Complexity	Probability of Error	Health/Safety	Public Disruption	Environmental	Economic	
	Asset tagging	3	5	4	3	2	
Alarm Testing - PM	3	2	3	4	3	3	12
HVAC Filters Inspections	1	1	1	1	1	4	4



CTA - Likelihood



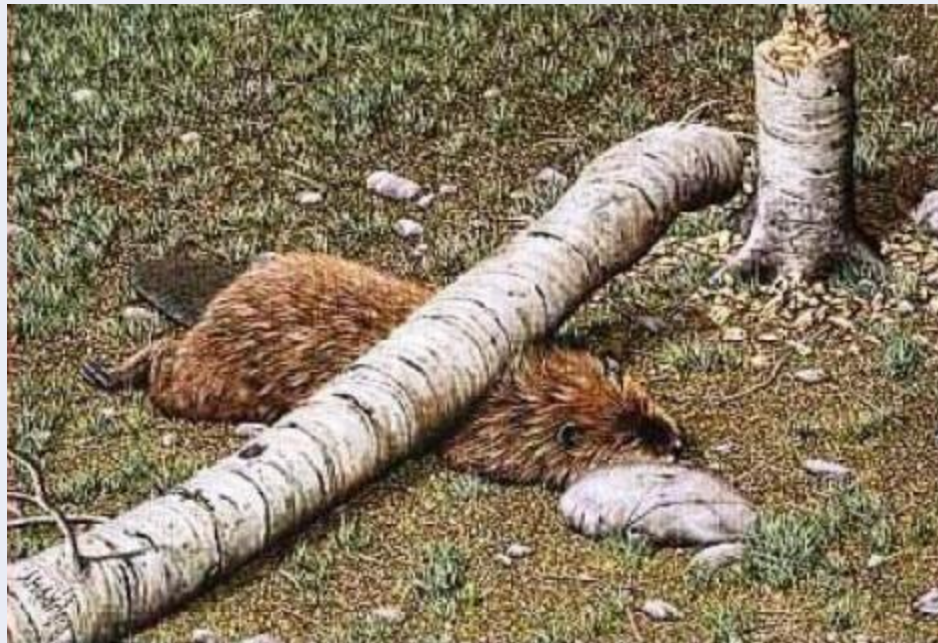
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CTA – Likelihood

Rating	Likelihood Criteria	
	Task Complexity	Probability (use historical data if possible)
5	<ul style="list-style-type: none"> Unfamiliar, highly complex Immediate response Troubleshooting and analysis required 	Possibility of repeated incidents (once or more per year)
4	<ul style="list-style-type: none"> Highly complex Prompt response Knowledge and analysis required 	Possibility of isolated incidents (once every 5 years)
3	<ul style="list-style-type: none"> Complex Some time to respond Knowledge required 	Possibility of occurring sometimes (once every 10 years)
2	Less complex but has potential for human error	Not likely to occur (once every 25 years)
1	Common, familiar, and non-complex tasks	Practically impossible (once every 100 years)



CTA - Consequences



CTA - Consequences

Rating	Consequence Criteria (ALWAYS ASSESS CRITERIA FIRST!)			
	Health/Safety	Public Disruption	Environmental	Economic
5	Loss of life	Extensive service disruption: <ul style="list-style-type: none"> • Arterial road out • Major line break / out • Region-wide boil water advisory 	<ul style="list-style-type: none"> • Extended incident: public notification required • Full-scale emergency response required • Ecosystem failure possible 	Loss > \$250,000
4	Permanent disability Loss of body part	Major service disruption: <ul style="list-style-type: none"> • Feeder road out • Minor line break / out • Localized boil water advisory 	<ul style="list-style-type: none"> • Major incident: reporting required • Fines/citations probable • Emergency response required • Significant threat to ecosystem 	Loss between \$25,000 and \$250,000
3	<ul style="list-style-type: none"> • Lost time injury • Illness without permanent disability 	Significant service disruption: <ul style="list-style-type: none"> • Local road out • Localized turbidity, no boil water • Localized noise 	<ul style="list-style-type: none"> • Moderate incident: reporting required • Minor response required • Minor threat to ecosystem 	Loss between \$5,000 and \$25,000
2	<ul style="list-style-type: none"> • Minor injury • Illness without lost time 	Minor service disruption: <ul style="list-style-type: none"> • Localized low pressure 	<ul style="list-style-type: none"> • Minor incident: reporting required • No response required 	Loss < \$5,000
1	No injury or illness	No service disruption	Minor incident: no reporting required	No loss



CTA - Sample with Extras

Task Name	Likelihood (1-5)		Consequence (1-5)				Criticality	Task Frequency 1-5	Notes	Existing procedure?	CSE Procedure Req'd	LKO Procedure Req'd
	Task Complexity	Probability of Error	Health/Safety	Public Disruption	Environmental	Economic						
Asset tagging	3	5	4	3	2	3	20	3	USC (WT); cl2	y	y	n
Alarm Testing - PM	3	2	3	4	3	3	12	3	Water/wastewater system only (not WT); Need to review criticality rating.	n	y	y
HVAC Filters Inspections	1	1	1	1	1	4	4	5	PS checklist	n	n	n



CTA – Procedure Development

Consequence

Low Medium High

5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5
	1	2	3	4	5

Likelihood



Training Program Table of Contents

- Developed in a workshop
- Input from senior management and superintendents
- Group the learning material into logical topics, subtopics, and modules
- Possible groupings:
 - Geographical
 - System flows
 - Priority Weighted
- Our topics:
 - MV Utility basics
 - Water & Wastewater Industry Basics
 - Watersheds
 - Source Water Treatment Plants
 - Water Supply
 - Water Supply Process
 - Urban Drainage System
 - Waste Water Collection Infrastructure



Table of Contents - Sample

Topic	Subtopic	Module	
Water Supply	Water mains	Water Main Basics	
		Types (i.e. according to sizes, materials, working pressures, etc.)	
		Custody transfer points	
		Pipe Connections and appertences (couplings, flanges, joint restraints)	
		Knowledge check	
		Procedures	
		Troubleshooting	
		Skills check	
	Reservoirs	Reservoirs	
		Under drains	
		Sump pumps	
		Overflow structures	
		Glenmore	
		Prospect	
		Greenwood	



Curriculum

Table of Contents

Modules to Assign

Competency Matrices

Assignment Criteria

Curriculum



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Curriculum – Sample

Topic	Subtopic	Module	SC Supt	Senior USC	USC
Water Supply	Water mains	Water Main Basics	x	x	x
		Types (i.e. according to sizes, materials, working pressures, etc.)	x	x	x
		Custody transfer points	x	x	x
		Pipe Connections and appertences (couplings, flanges, joint restraints)	x	x	x
		Knowledge check		x	x
		Procedures		x	x
		Troubleshooting		x	x
		Skills check		x	x
	Reservoirs	Reservoirs	x	x	x
		Under drains			
		Sump pumps			
		Overflow structures			
		Glenmore	x	x	x
		Prospect	x	x	x
		Greenwood	x	x	x
		Sasamat	x	x	x
		Little Mountain	x	x	x
		Kersland	x	x	x



Reference Material Analysis & Development Plan

- Gather existing training and reference material
- Rate the quality of the material
- Organize the reference material into modules and topics from the TOC
- Assign cumulative criticality ratings to the modules
- Estimate costs
- Develop training material based on criticality and cost



Development Plan Example

Topic	Subtopic	Module	Quality Of Primary resources	Number of units	Development cost	Contractor manhours	Total cost	Total MV manhours	Cumulative priority (from CTAs)
MV Utility Basics									
	Metro Vancouver corporate overview	Metro Vancouver corporate overview	4	1	\$0	0	\$0	0	0
		Knowledge check	4	1	\$0	0	\$0	0	
	Utilities systems overview	Utilities overview	3	0.33	\$4,125	43	\$4,563	18	0
		Organizational overview	1	0.33	\$8,250	86	\$9,250	19	
		Utilities Geographical layout	1	0.33	\$8,250	86	\$9,250	19	
		Knowledge check	4	1	\$0	0	\$0	0	
	Management Systems Fundamentals	Utilities Project Management	2	3	\$56,250	585	\$56,719	85	330



Training Program Design - Exercise

- Pick one of the following three positions:
 1. Cabin Boy or Girl, Pirate Galleon, 1650 Carribean
 2. Ensign (or Red Shirt), Starship Enterprise, 2432
- For this position, create:
 - Task List (10-20 tasks)
 - Competency Matrix (3-5 roles)
 - Critical Task Analysis of 5 tasks
- If time permits:
 - Table of Contents
 - Curriculum



Questions?



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